U.S. Department
of Transportation
National Highway
Traffic Safety
Administration

http://www.nhtsa.dot.gov

DOT HS 809 048

April 2000

Standardized Reporting Using CODES

(Crash Outcome Data Evaluation System)

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Technical Report Documentation Page

1. Report No. DOT HS 808 048	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Standardized Reporting Using CODES (Crash Outcome Data Evaluation System)		5. Report Date December 1999	
		6. Performing Organization Code	
7. Author(s) Karl S. Finison		8. Performing Organization Report No.	
9. Performing Organization Name and Address Maine Health Information Center Box 360 Manchester, ME 04351 Office of Data, Research, and Vital Statistics Bureau of Health Maine Department of Human Services 35 Anthony Avenue 11 State House Station Augusta, Maine 04333		10. Work Unit No. (TRAIS)n code	
		11. Contract of Grant No. DTNH-22-97-H-07282	
12. Sponsoring Agency Name and Address National Highway Traffic Safety Administration 400 Seventh Street, S.W. Washington, DC 20590		13. Type of Report and Period Covered NHTSA REPORT	
		14. Sponsoring Agency Code	
15. Supplementary Notes Dennis Utter served as the NHTSA Contract Office Technical Representative for the study			
16. Abstract While CODES projects have expanded to 25 states, there is no standardized reporting of the outcome measures that are available with linked data. This paper describes our efforts to build a standard format for reporting these outcomes. This format is conceptualized by laying the injury “pyramid” on its side. Outcome measures are reported as columns across a page with increasing levels of severity from left to right. We discuss several aspects of format development including levels of reporting, specific outcome measures, rates, and selection of appropriate denominators. These simplified reports can be used to plan further studies or as a source of information for fact sheets for further dissemination. Examples of implementation of these reports are provided from the Maine CODES project.			
17. Key Words CODES, linked data, probabilistic linkage, management report, Maine, crash, outcome measures		18. Distribution Statement Document is available to the public through the National Technical Information Service, Springfield, VA 22161	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No of Pages 29	22. Price

Form DOT F1700.7 (8-72) **Reproduction of completed page authorized**

Standardized Reporting Using CODES (Crash Outcome Data Evaluation System)

Prepared by the Maine Health Information Center
For the
Office of Data, Research, and Vital Statistics
Bureau of Health
Maine Department of Human Services

Funded by the National Highway Traffic Safety Administration
Project No. DTNH-22-97-H-07282
November 1999

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Executive Summary

While CODES projects have expanded to more than 20 states, there is no standardized reporting of the outcome measures that are available with linked data.

This paper describes our efforts to build a standard format for reporting these outcomes. This format is conceptualized by laying the injury "pyramid" on its side. Outcome measures are reported as columns across a page with increasing levels of severity from left to right.

We discuss several aspects of format development including levels of reporting, specific outcome measures, rates, and selection of appropriate denominators.

These simplified reports can be used to plan further studies or as a source of information for fact sheets for further dissemination.

Examples of implementation of these reports are provided from the Maine CODES project.

Introduction

CODES (Crash Outcome Data Evaluation System) represents an effort by the National Highway Traffic Safety Administration (NHTSA) to link information collected by police on crash reports to databases (e.g. EMS, hospital discharge, death certificate) that contain detailed medical information[1].

Each person identified on the police crash report who was injured may be linked to one or more medical records, providing a rich new source on outcomes. The linked data allows for identification of specific types of injuries (head, lower extremity), severity of injury (required hospitalization), cost of injury (hospital charges), and medical system response (EMS response time, transfer, hospitalized). Data available in hospital discharge abstracts and death certificate records includes ICD-9 (International Classification of Disease) coding which allows for more precise identification of the nature and severity of injury than the police are qualified to report accurately.

Since 1993, CODES has expanded to include half of the states. State specific projects have generated a wealth of special studies using the linked data[2]. While considerable effort has been given to standardizing the procedures for linking data, less effort has been given to standardize the reporting of CODES data.

Maine developed an initial standardized report format in 1995 and revised it during the 1998 project[3]. This paper describes the results of that work.

Linked Data – Why Standard Reporting?

Prior to the development of CODES, reporting was limited to counts of crashes, vehicles involved, and fatalities. Occasionally, police levels of injury severity were used (e.g. incapacitated, non-incapacitated, or property damage only)[4].

Reporting of CODES data in a standardized format would be useful for comparisons between states, to simplify and foster dissemination of data within states, to target specific areas for planning and research, and to promote a national report of CODES outcome data.

1. Comparisons between states.

Currently each CODES state has developed its own research and reporting agenda and many useful studies have used the linked data. Less attention has been given to standardizing reporting of outcome measures. Standardization of outcome measurement would foster comparisons between states. Some efforts were made during the first CODES project to standardize outcomes associated with seat belts and helmets[5].

2. Simplify and foster dissemination of data.

State and local officials can benefit from data that are simplified. While epidemiological studies reporting odds ratios or multivariate results are important, local highway safety officials are more likely to use simplified reports containing absolute counts or percents. For example, reporting that young drivers who were driving too fast incurred $10 million in hospital charges has more utility than reporting that the odds ratio of injury adjusted for speed is 1.28. CODES information should be put in a format that has immediate utility to citizens and administrators. Standardized reports provide an effective and immediate source of information for graphical and fact sheet development.

3. Target areas for planning and research.

Within states, planning activities and selection of topics for further study may often be based on high volume of crash locations or low volume fatalities. CODES projects have helped provide new data that can measure outcomes between these two extremes and capture a larger volume of the more severe injuries and associated cost. By standardizing the format of reporting, state officials can identify problem areas and ensure that decisions to allocate resources target those areas.

4. Promote a national report of CODES data.

Standardized reporting of linked data would permit the CODES states to gauge progress toward state safety goals. In addition, NHTSA could compile all of the state reports into a national CODES report that over time could be used to gauge progress toward national safety goals. This would be similar to current standard reporting prepared by NHTSA[4].

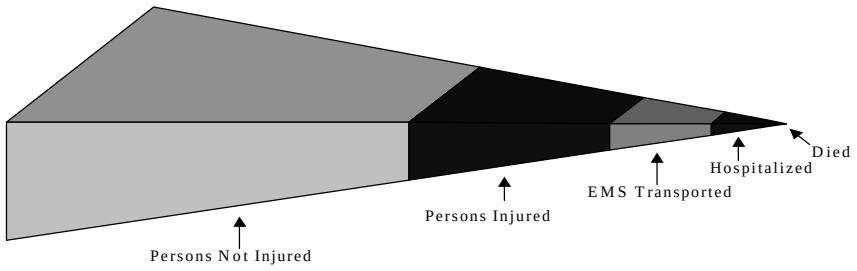
The remainder of this paper will address the levels of reporting, types of outcome measures, and use of denominators to generate rates. Examples are provided from the Maine CODES project.

Methods - Standardized Report Development

We view the simplified reporting of CODES data as a spreadsheet of a police reported classification variable (rows) by the outcome measures (columns) that result from the linked data. Classification variables include much of the information recorded on the police crash report (e.g. type of crash, time of day, age of driver, seating position) while outcome measures will include data linked through CODES (e.g. transported by EMS, hospital charges, hospitalized or died with a head injury).

From this perspective the CODES outcomes measures correspond with laying the injury pyramid on its side with severity of injury increasing from the base (left) to the top (right) of the pyramid.

Figure 1. Injury Pyramid Rotated on Its Side



Methods - Levels of Reporting

Consistent with existing NHTSA reporting (see Exhibit 1), the report format can include any of the three levels of data collected on police crash reports:

1. Crash Characteristics
2. Vehicle Characteristics
3. Characteristics of Persons Involved

In addition, persons involved can be subset further to distinguish drivers from passengers. Bicyclists and pedestrians included on the crash reports can be considered separately. In the case of reports designed to measure the EMS system, reporting could begin with access time to EMS (time of call to EMS minus time of crash).

Methods - Classification Variables

Consistent with the injury matrix developed by Haddon[6], the standardized format could report outcome for many environmental, vehicle, or human factors associated with motor vehicle crashes. Examples are:

1. Day of crash (season, day of week, holidays)
2. Time of day (daylight, dusk, night)
3. Weather (fog, snow)
4. Road conditions (dry, ice, not plowed, not sanded)
5. Type of crash (multi-vehicle, direction of impact, rollover, fixed object)
6. Animals (moose, deer, bear)
7. Road class (local, arterial, collector, interstate)
8. Shoulder type and lane width (none, gravel, paved)
9. Other road characteristics (guardrails, median barriers, signalized)
10. Crash location (intersection, curved road, or specific road identification)
11. Urban / Rural (population density of crash location)
12. Type and weight of vehicle (passenger, light truck, commercial truck)
13. Commercial truck cargo weight and type
14. Condition of vehicle (defective brakes)1
15. Age and sex (driver, passenger, pedestrian, pedal cyclist)
16. Driver license (permit, suspended, multiple OUI, vision impaired)
17. Driver condition (OUI, asleep or fatigued)
18. Driver contributing factors (speeding, failure to yield, passing, U-turn, cell phone use)

19. Seating Position (driver, number of passengers)
20. Ejection from vehicle (driver, passenger)
21. EMS response (crew training level, time of arrival at scene minus time of crash, emergency transport/transfer)

These classification variables form the basis for the rows in our report development.

Methods - Outcome Measures

After a review with the Maine CODES Advisory Committee, a series of outcome measures were agreed upon. These included:

1. Injured (Non-fatal)
2. Transported by EMS
3. Hospitalized
4. Hospital Days
5. Hospital Charges
6. Hospitalized or Died with a Head Injury
7. Fatal (Injuries)
8. Years of Potential Life Lost

Injured persons were defined to include all police reported fatal, incapacitating, or non-incapacitating injuries or all person-specific crash reports that linked to an EMS or hospital discharge record. For a national CODES report, this definition could be revised to include linkage to any medical record (EMS, ED, Hospital, Outpatient) or insurance record indicating payment for medical treatment.

For a report to be effective, it has to present the data in a logical way. These variables were reported in columns in order of increasing severity, using the "pyramid" analogy.

Our list of outcome measures was not a definitive list. While we reported head injuries, the linked data could also be used to report other injury types (e.g. trunk, lower limb, upper limb) and several CODES states have done this[7-11]. However, the definitions for injury type reporting using the International Classification of Diseases 9th Revision (ICD-9) coding have not been standardized. CODES states have also used software (i.e. ICDMAP-90) to generate the Injury Severity Score (ISS) as an outcome measure[12]. Finally, outcome measures could be left as discrete entities or combined to avoid double counting (since some patients

hospitalized also died, these could be reported as a single column – hospitalized or died).

Methods - Denominators

Although the raw counts of injured, hospital charges, head injured were most important to highway safety planners, it was also useful to generate comparative rates. To understand the context of the raw counts, they must be seen in proportion to the population as a whole. Raw counts divided by the total population under study indicates the percentage of the total involved.

Rates may be internal to the CODES linked data (e.g. percent of persons involved who were injured). For rates internal to the CODES linked data we have computed the observed to expected ratio which is an estimate of the relative risk of injury for that category to all types of crashes.

Some rates require denominators from other sources (e.g. census population, licensed drivers, million vehicle miles traveled).

Finally, since CODES states include crashes occurring on highways within the state to both in-state and out-of-state drivers, consideration should be given to selecting in-state drivers in reporting. Ideally, the unit being measured in the numerator should be compatible with the units included in the denominator[13].

We implemented the standardized report format using the Statistical Analysis System (SAS) version 6.1. (Since the CODES linked data are stored at the person unit record level, this involved a single data step to create the outcome measures and a simple summary and print procedure to generate the rates and each report).

Standard Report Formats – Examples from the Maine CODES Project

Application of these methods for report format are provided with examples from the Maine CODES project in the exhibits that follow.

Exhibits 2-4 provide examples of the three different levels of reporting and the outcome measures.

In our standard report, Type of Crash (Exhibit 2), the number of crashes are reported as the first column of data on the report. Vehicles and persons involved are also reported along with several outcome measures.

In our standard report, Type of Vehicle (Exhibit 3), number of vehicles and persons are reported. Crashes are not reported on this report since the report is specific to the type of vehicle occupied.
In our standard report, Position in Vehicle (Exhibit 4), persons are reported but vehicles and crashes are not since seating position is specific to a person.

Exhibits 5-7 provide examples of the use of different types of denominators to generate rates.

In our standard report, Road Federal Functional Class (Exhibit 5), million vehicle miles traveled were supplied by the state Department of Transportation and incorporated as a denominator. This yielded rates of hospitalized or died per 100 million vehicle miles.

In our standard report, Male Drivers (Exhibit 6), the number of Maine licensed drivers were supplied by the Maine Secretary of State, Bureau of Motor Vehicles and incorporated as a denominator. This yielded age comparative injury rates per 100,000 licensed drivers.

In our standard report, Male Bicyclists (Exhibit 7), population census estimates for 1996 were supplied by the state Office of Data, Research, and Vital Statistics. This yielded injury rates per 100,000 population.

In total, selection of the appropriate denominator will depend on the reporting level and the classification variable in use.

Limitations of Standardized Reporting

Footnoting was an important consideration during the format development process. CODES software is unable to link all records (estimates of false negative rates vary by state depending on the quality of police reported crash information). We added a footnote to indicate that the outcome measures underestimated the true injury burden.

We noted that coding was based on police crash reports and for some variables (e.g. seat belt use, alcohol) may be less reliable than others (e.g. day of crash, time of crash).

For some variables, states may vary in how they capture the data (e.g. seat belts and/or air bag). States may also vary in the level of detail for which denominator information is collected or estimated.

We implemented a format with columns of increasing injury severity measures moving from left-to-right. This insured that if a police reported classification variable had many values, or stratification by more than one variable was requested, we would not have page wrap for the outcome columns – this required landscape mode printing.
While the format provides easily understood and useful information, it does not preclude the need for more sophisticated statistical procedures. For example, the relationships between driver's age, driver's sex, alcohol, speeding, and time of day on crash outcome would require multivariate methods to evaluate. A standardized report on belt use indicated that 91 percent of occupants of passenger cars and light trucks were belted during 1996, some 30 percent higher than the rate reported in observational studies in Maine. Special methods were required to adjust for the over-reporting of belt use. We did not implement statistical significance testing of rate comparisons, although this could be added.

Using Standardized Reports as a Research Planning Guide

The CODES data added new information that can be used in the planning process to select topics for further study.

In our example report, Type of Crash (Exhibit 2), crashes involving vehicles that ran off the road represented 22 percent (8,986) of the crashes during 1996 but 41 percent ($5.3 million) of the total hospital charges. Upon review of this report, the Maine CODES Advisory Committee members selected this as one topic for further study.

The standardized report format also lends itself to identifying more specific areas for further study. This process I sometimes called "drill-down" reporting. In the report, Ran Off Road (Exhibit 8), we further examined a subset (Maine drivers only) of ran off the road crashes to determine the weather and road conditions during the crash. Vehicles that ran off the road with dry road conditions accounted for only 35 percent of the drivers but represented 79 percent of the hospital charges. A similar pattern was also noted for the other outcome measures. Based on this drill-down report, the research topic selected for study excluded the crashes occurring during adverse weather conditions that had less

severe outcomes. The final study of crashes involving vehicles that ran off a dry road incorporated a variety of additional drill-down standardized reports[14].

"The Run Off the Road report provided significant findings that we were previously unaware of. The hospital cost linkage showed them to be far worse than I expected." *Gerald Audibert, Safety Management Coordinator, Maine Department of Transportation.*

Using Standardized Reports as a Source for Fact Sheets

Standard reports are management tools that help individuals quickly grasp the essential elements found in raw data. The standardized report formats provide a wealth of simplified data that can be utilized quickly and easily to develop fact sheets or other materials for dissemination of CODES information. The ability to easily summarize the data clearly and efficiently is important[15]. Data should be reported in a simplified form that is readily understood and immediately useful to those on the front line[16].

Crashes involving young drivers are a national problem and the standardized reports revealed the injury and cost burden in Maine. Drill-down reports using the standardized reporting format compared these drivers to older drivers and compared some of the factors associated with crashes involving young drivers. We utilized the results to generate a fact sheet on young drivers (Exhibit 9). The fact sheet was patterned after NHTSA's Traffic Safety Facts.

The additional information available through CODES (e.g. EMS transports or hospitalizations) is particularly useful for smaller, rural states where the numbers of motor vehicle fatalities are insufficient to produce statistical validity.

"The fact sheets were very useful because we deal with the general public and they were put together in a format that was understandable and useable. We get people calling us all the time and respond by sending out the CODES fact sheets. The linked hospital cost information was particularly useful to our seat belt study group". *Tracy Poulin, Bureau of Highway Safety, Maine Department of Public Safety.*

Summary

NHTSA has a standard annual report Traffic Safety Facts based on data from the FARS and GES systems. Currently CODES reporting is encouraged to meet state-specific needs and, thus, there is no national reporting format for all of the CODES states to follow. This paper has introduced the concept of a standardized report format for all CODES states to follow, not only for routine reporting within the state but also for the purpose of generating a national CODES report.

The CODES linked data lend themselves to a simplified standard reporting format. We have implemented this in a simple spreadsheet format with columns representing increasing levels of outcome severity from left-to-right. Appropriate levels of reporting, rates, and denominators should be considered in the report planning process.

While these reports can be tailored to state specific needs, states could also benefit from comparative data if the reporting of outcome measures were standardized.

Finally, the development of the format and contents of these reports was dependent on the active participation of the Maine CODES Advisory Committee[17]. The reports went through a process of review, comment, and revision by those people who would actively utilize the information resulting from the reports.

"I found the new data from CODES about the hospital costs associated with crashes enlightening. You can't get that from police crash reports. The fact sheet about young drivers was particularly useful". *Richard Nickless, Management Analyst, Office of Planning, Bureau of Motor Vehicles, Maine Department of Secretary of State.*

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Exhibit 1: *Traffic Safety Facts 1997: A Compilation of Motor Vehicle Crash Data from the Fatality Analysis Reporting System and the General Estimates System.* National Highway Traffic Safety Administration, November, 1998. DOT HS 808 806.

Table 66
Vehicle Occupants Killed or Injured, by Vehicle Type, Person Type, and Injury Severity

Vehicle and Person Type	Occupants Killed	Occupants Injured by Injury Severity			Total Injured	Total Killed or Injured
		Incapacitating	Nonincapacitating	Other		
Passenger Car						
Drivers	14,710	178,000	416,000	993,000	1,587,000	1,601,000
Passengers	7,204	84,000	200,000	506,000	791,000	798,000
Unknown	75	*	*	*	*	*
Total	21,989	262,000	616,000	1,499,000	2,378,000	2,400,000

Table 29
Crashes by Speed Limit, Crash Type, and Crash Severity

Speed Limit	Crash Type: Single Vehicle Number	Single Vehicle Percent	Multiple Vehicle Number	Multiple Vehicle Percent	Total Number	Total Percent
Fatal Crashes						
30 mph or less	2,945	14.2	1,169	7.1	**4,114**	**11.0**
35 or 40 mph	3,745	18.0	2,662	16.1	**6,407**	**17.2**
45 or 50 mph	3,193	15.4	3,202	19.4	**6,395**	**17.2**
55 mph	6,578	31.6	6,258	38.0	**12,836**	**34.4**
60 mph or higher	3,530	17.0	2,810	17.0	**6,340**	**17.0**
No Statutory Limit	119	0.6	43	0.3	**162**	**0.4**
Unknown	682	3.3	344	2.1	**1,026**	**2.8**
Total	**20,792**	**100.0**	**16,488**	**100.0**	**37,280**	**100.0**

Table 39
Single- and Two-Vehicle Crashes by Vehicle Maneuver and Crash Severity

Vehicle Maneuver	Crash Severity: Fatal Number	Fatal Percent	Injury Number	Injury Percent	Property Damage Only Number	Property Damage Only Percent	Total Number	Total Percent
Going Straight	33,397	68.3	2,086,000	63.1	4,119,000	56.1	6,239,000	58.3
Turning Left	2,892	5.9	381,000	11.5	686,000	9.3	1,071,000	10.0
Stopped in Traffic Lane	657	1.3	295,000	8.9	728,000	9.9	1,024,000	9.6
Turning Right	309	0.6	79,000	2.4	285,000	3.9	365,000	3.4

EXHIBIT 2

15:46 Friday, November 19, 1999

TYPE OF CRASH
MAINE CRASH OUTCOME DATA EVALUATION SYSTEM, 1996 LINKED DATA BASE

TYPE OF CRASH	NUMBER OF CRASHES	VEHICLES INVOLVED	PERSONS INVOLVED	PERCENT INJURED	INJURED	OBSERVED EXPECTED RATIO	TRANSPORTED BY EMS#	HOSPITALIZED#	HOSPITAL DAYS#	HOSPITAL CHARGES#	HEAD INJURY	FATAL	YEARS OF POTENTIAL LIFE LOST
OBJECT IN ROAD	1530	1780	2562	375	14.6	1.04	157	35	182	402238	14	5	131
REAR END SIDESWIPE	12637	25748	40100	3597	9.0	0.64	1391	93	394	1017421	30	3	117
HEAD ON SIDESWIPE	2222	4357	6671	1472	22.1	1.57	687	150	1128	3000814	51	38	1372
INTERSECTION MOVEMENT	8368	16518	25533	3344	13.1	0.93	1281	132	704	1596084	47	18	603
PEDESTRIANS	337	674	875	274	31.3	2.23	156	44	238	660222	22	13	362
TRAIN	7	11	15	1	6.7	0.47	0	0	0	0	0	0	0
RAN OFF ROAD	8986	9558	14473	4028	27.8	1.98	1750	341	1902	5343314	146	73	3086
ANIMAL	4155	4209	6602	276	4.2	0.30	80	10	25	63949	6	4	169
BIKE	285	575	763	258	33.8	2.41	112	34	267	619558	20	2	119
OTHER	451	606	975	94	9.6	0.69	42	8	33	106368	6	4	215
JACKKNIFE	37	48	67	16	23.9	1.70	8	0	0	0	0	0	0
ROLLOVER	419	438	651	254	39.0	2.78	97	19	85	273084	12	5	229
FIRE	206	206	324	4	1.2	0.09	1	0	0	0	0	0	0
SUBMERSION	7	7	13	3	23.1	1.64	1	0	0	0	0	1	33
ROCK THROWN	22	41	62	2	3.2	0.23	1	0	0	0	0	0	0
NOT CODED	11	18	26	5	19.2	1.37	0	0	0	0	0	0	0
TOTALS	39680	64794	99712	14003	14.0	1.00	5764	866	4958	13083052	354	166	6437

CODING OF THIS DATA ITEM IS BASED ON POLICE CRASH REPORTS
INJURED IS POLICE REPORTED FATAL, INCAPACITATING, NON-INCAPACITATING OR LINKED TO AN EMS OR HOSPITAL RECORD
YEARS OF POTENTIAL LIFE IS BASED ON LIFE EXPECTANCY FROM LIFE-TABLES FROM OFFICE OF DATA RESEARCH AND VITAL STATISTICS
HEAD INJURY ARE PERSONS HOSPITALIZED OR DIED WITH ICD-9 CODES 800-801,803-804,850-854
EXPECTED IS THE NUMBER OF PERSONS INVOLVED FOR THAT CATEGORY MULTIPLIED BY THE PERCENT INJURED FOR ALL CRASHES
#COLUMN REPRESENTS LINKED RECORDS ONLY AND UNDERESTIMATES ACTUAL COUNTS DUE TO LIMITATIONS IN THE METHODS OF DATA COLLECTION

EXHIBIT 3

15:46 Friday, November 19, 1999

TYPE OF VEHICLE
MAINE CRASH OUTCOME DATA EVALUATION SYSTEM, 1996 LINKED DATA BASE

TYPE OF VEHICLE	VEHICLES INVOLVED	PERSONS INVOLVED	INJURED	PERCENT INJURED	OBSERVED EXPECTED RATIO	TRANSPORTED BY EMS#	HOSPITALIZED#	HOSPITAL DAYS#	HOSPITAL CHARGES#	HEAD INJURY	FATAL	YEARS OF POTENTIAL LIFE LOST
PASSENGER CARS	39984	61865	9359	15.1	1.08	3966	519	2698	7134060	190	90	3486
VANS LIGHT TRUCKS	19560	29432	3421	11.6	0.83	1253	183	1103	2846459	80	41	1557
MOTORBIKES	425	482	334	69.3	4.93	162	63	386	1397023	34	15	709
SCHOOL BUS	148	2269	59	2.6	0.19	16	1	1	3872	0	0	0
COMMERCIAL TRUCKS	2264	2599	159	6.1	0.44	48	7	9	26566	4	2	42
BICYCLES	327	334	283	84.7	6.03	126	36	452	877774	22	1	53
PEDESTRIANS	318	358	259	72.3	5.15	147	45	238	654532	21	12	348
OTHER OR UNKNOWN	1768	2373	129	5.4	0.39	46	12	71	142766	3	5	241
TOTALS	64794	99712	14003	14.0	1.00	5764	866	4958	13083052	354	166	6437

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HEAD INJURY ARE PERSONS HOSPITALIZED OR DIED WITH ICD-9 CODES 800-801,803-804,850-854
EXPECTED IS THE NUMBER OF PERSONS INVOLVED FOR THAT CATEGORY MULTIPLIED BY THE PERCENT INJURED FOR ALL CRASHES
#COLUMN REPRESENTS LINKED RECORDS ONLY AND UNDERESTIMATES ACTUAL COUNTS DUE TO LIMITATIONS IN THE METHODS OF DATA COLLECTION

EXHIBIT 4

15:46 Friday, November 19, 1999

POSITION IN VEHICLE
MAINE CRASH OUTCOME DATA EVALUATION SYSTEM, 1996 LINKED DATA BASE

POSITION IN VEHICLE	PERSONS INVOLVED	INJURED	PERCENT INJURED	OBSERVED EXPECTED RATIO	TRANSPORTED BY EMS#	HOSPITALIZED#	HOSPITAL DAYS#	HOSPITAL CHARGES#	HEAD INJURY	FATAL	YEARS OF POTENTIAL LIFE LOST
DRIVER	62584	9101	14.5	1.04	3731	535	2955	7857097	200	89	2983
MIDDLE FRONT	2238	264	11.8	0.84	114	9	70	172873	10	7	313
RIGHT FRONT	19216	2499	13.0	0.93	985	121	598	1462777	46	28	1268
LEFT REAR	3871	413	10.7	0.76	178	24	113	291309	9	5	264
MIDDLE REAR	1593	158	9.9	0.71	61	2	6	15123	2	1	67
RIGHT REAR	4657	507	10.9	0.78	191	17	65	194543	8	4	240
REAR COMPARTMENT	3119	117	3.8	0.27	35	3	6	13342	0	0	0
HANGING ON	54	20	37.0	2.64	12	4	14	51314	0	0	0
MC BIKE DRIVER	784	587	74.9	5.33	272	99	823	2218420	51	14	663
MC BIKE PASSENGER	77	41	53.2	3.79	20	2	36	104719	2	1	50
MC BIKE SIDE CAR HANG ON	13	1	7.7	0.55	1	0	0	0	0	0	0
NOT CODED	1506	295	19.6	1.39	164	50	272	701535	26	17	589
TOTALS	99712	14003	14.0	1.00	5764	866	4958	13083052	354	166	6437

CODING OF THIS DATA ITEM IS BASED ON POLICE CRASH REPORTS
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EXHIBIT 5

15:46 Friday, November 19, 1999

ROAD FEDERAL FUNCTIONAL CLASS BASED ON LINKAGE TO TINIS A AND B RECORDS
THOSE WITH MISSING ROAD CLASSIFICATION NOT INCLUDED
MAINE CRASH OUTCOME DATA EVALUATION SYSTEM, 1996 LINKED DATA BASE

ROAD FEDERAL FUNCTIONAL CLASS	1996 100 MILLION VEHICLE MILES TRAVELLED	NUMBER OF CRASHES	PERSONS INVOLVED	INJURED	TRANSPORTED BY EMS#	HOSPITALIZED#	HOSPITAL DAYS#	HOSPITAL CHARGES#	HEAD INJURY#	HOSPITALIZED OR DIED	FATAL	YEARS OF POTENTIAL LIFE LOST	INJURED PER 100 MILLION VEHICLE MILES	HOSPITALIZED OR DIED PER 100 MILLION VEH
LOCAL	13.8	6562	13945	2101	821	155	899	2473432	59	181	32	1503	152.69	13.15
INTERSTATE	24.0	2538	6128	777	295	45	188	553139	22	49	9	309	32.44	2.05
PRINCIPAL ARTERIAL	26.7	9396	27521	3453	1439	194	894	2399930	79	225	39	1314	129.37	8.43
MINOR ARTERIAL	26.5	8260	22681	3008	1273	162	957	2604322	58	179	26	998	113.42	6.75
COLLECTOR	35.8	10606	24451	3936	1670	255	1612	3937586	112	296	52	2041	109.82	8.26
TOTAL	128.1	37362	94726	13275	5498	811	4550	11968409	330	930	158	6165	103.60	7.26

CODING OF THIS DATA ITEM IS BASED ON POLICE CRASH REPORTS
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EXHIBIT 6

15:46 Friday, November 19, 1999

MALE DRIVERS (MAINE LICENSED) - CARS AND LIGHT TRUCKS ONLY
MAINE CRASH OUTCOME DATA EVALUATION SYSTEM, 1996 LINKED DATA BASE

RIVERS GE ROUP	LICENSED MALE DRIVERS	DRIVERS INVOLVED	INVOLVED RATE PER 100,000 DRIVERS	DRIVERS INJURED	INJURY RATE PER 100,000 DRIVERS	TRANSPORTED BY EMS#	HOSPITALIZED#	HOSPITAL DAYS#	HOSPITAL CHARGES#	HEAD INJURY#	FATAL	YEARS OF POTENTIAL LIFE LOST
6	2893	856	29588.7	133	4597.3	49	3	15	35581	2	1	58
7	5604	1441	25713.8	198	3533.2	57	8	43	107943	6	3	170
8	6658	1339	20111.1	221	3319.3	78	7	67	233948	4	1	56
9	7019	1061	15116.1	185	2635.7	65	13	60	211851	7	0	0
0	6309	845	13393.6	125	1981.3	47	6	28	88200	0	1	54
1	6535	898	13741.4	136	2081.1	54	12	57	188335	7	0	0
2	6541	788	12047.1	109	1666.4	42	9	26	68008	1	0	0
3	6644	807	12146.3	112	1685.7	46	7	28	77069	4	2	102
4	6696	747	11155.9	101	1508.4	38	7	24	84342	4	3	151
5-29	37536	3491	9300.4	475	1265.5	201	34	166	443044	12	6	282
0-34	43680	3363	7699.2	398	911.2	154	25	169	563783	12	8	342
5-39	50082	3205	6399.5	386	770.7	153	26	174	488906	14	2	75
0-44	49520	2834	5722.9	326	658.3	122	20	125	348119	7	7	235
5-49	47353	2455	5184.5	269	568.1	93	12	28	120043	7	4	117
0-54	36783	1713	4657.0	189	513.8	79	22	154	351473	5	0	0
5-59	27075	1238	4572.5	121	446.9	48	7	28	67974	2	3	61
0-64	24277	1127	4642.3	135	556.1	50	13	56	149289	3	1	16
5-69	22267	1060	4760.4	134	601.8	58	14	24	58897	3	2	26
0ANDOVR	42313	2208	5218.3	335	791.7	131	29	248	858956	11	13	81
OTALS	435785	31476	7222.8	4088	938.1	1565	274	1520	4545761	111	57	1826

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EXHIBIT 7

15:46 Friday, November 19, 1999

MALE BICYCLISTS INVOLVED IN MOTOR VEHICLE CRASHES
MAINE CRASH OUTCOME DATA EVALUATION SYSTEM, 1996 LINKED DATA BASE
TYPE OF VEHICLE 17 OR SEATING POSITION 21

AGE GROUP	MALE POPULATION	MALE BICYCLISTS INVOLVED	INJURED	INJURY RATE PER 100,000	TRANSPORTED BY EMS#	HOSPITALIZED#	HOSPITAL DAYS#	HOSPITAL CHARGES#	HEAD INJURY	FATAL	YEARS OF POTENTIAL LIFE LOST
AGE 0 OR MISSING	7155	2	1	14.0	0	0	0	0	0	0	0
1-4	31089	1	1	3.2	0	0	0	0	0	0	0
5-9	44607	34	33	74.0	16	6	209	287824	5	0	0
10-14	46549	96	78	167.6	32	9	69	136258	5	0	0
15	9205	17	15	163.0	7	0	0	0	0	0	0
16	9126	12	11	120.5	6	3	8	21823	3	0	0
17	8858	4	4	45.2	1	1	1	1251	0	0	0
18	8270	7	7	84.6	5	3	12	26012	2	0	0
19	8228	5	5	60.8	2	1	15	62985	1	0	0
20	8092	6	4	49.4	1	0	0	0	0	0	0
21	7815	14	10	128.0	5	3	13	21220	1	1	53
22	7669	2	1	13.0	1	0	0	0	0	0	0
23	7956	6	4	50.3	2	0	0	0	0	0	0
24	8359	7	7	83.7	0	0	0	0	0	0	0
25-29	39191	14	13	33.2	5	0	0	0	0	0	0
30-34	49074	11	9	18.3	3	0	0	0	0	0	0
35-39	54210	4	4	7.4	3	0	0	0	0	0	0
40-44	52011	5	3	5.8	1	0	0	0	0	0	0
45-49	44870	7	6	13.4	4	4	6	14442	0	0	0
55-59	25850	2	1	3.9	0	0	0	0	0	0	0
60-64	23765	2	1	4.2	1	1	7	11609	1	0	0
65-69	22943	3	2	8.7	0	0	0	0	0	0	0
70-74	19443	3	3	15.4	3	0	0	0	0	0	0
85 AND OVER	5566	7	3	53.9	0	0	0	0	0	0	0
TOTALS	604751	271	226	37.4	98	31	340	583424	18	1	53

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EXHIBIT 8

15:46 Friday, November 19, 1999

RAN OFF ROAD, MAINE DRIVERS ONLY, PASSENGERS EXCLUDED
PASSENGER CARS AND LIGHT TRUCKS
MAINE CRASH OUTCOME DATA EVALUATION SYSTEM, 1996 LINKED DATA BASE

OAD WEATHER CONDITIONS	DRIVERS INVOLVED	DRIVERS INVOLVED PER 100,000 DRIVERS	DRIVERS INJURED	PERCENT INJURED	OBSERVED EXPECTED RATIO	INJURED PER 100,000 DRIVERS	TRANSPORTED BY EMS#	HOSPITALIZED#	HOSPITAL DAYS#	HOSPITAL CHARGES#	HEAD INJURY#	HOSPITALIZED OR DIED	FATAL	YEARS OF POTENTIAL LIFE LOST
RY CLEAR OR CLOUDY	2641	302.3	1178	44.6	1.41	134.8	548	155	1069	3220254	72	181	36	1382
AIN WET PAVEMENT	653	74.7	224	34.3	1.09	25.6	101	22	98	273369	3	24	3	90
CE OR SNOW NOT SANDED	2442	279.5	529	21.7	0.69	60.5	201	22	91	241396	10	27	6	255
CE OR SNOW SANDED	1257	143.9	263	20.9	0.66	30.1	103	15	71	145139	8	16	1	36
THER ADVERSE WEATHER ROAD	638	73.0	212	33.2	1.05	24.3	86	17	69	199902	5	21	4	179
OTAL	7631	873.4	2406	31.5	1.00	275.4	1039	231	1398	4080060	98	269	50	1943

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EXHIBIT 9

Young Drivers
Maine Crash Facts, 1996

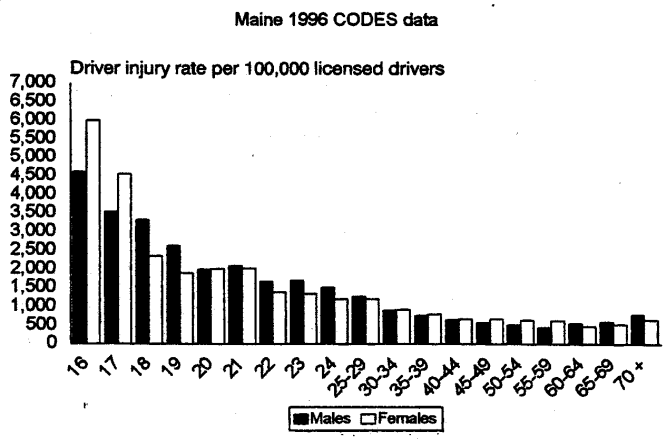
Maine Crash Outcome Data Evaluation System (CODES)

During 1996 14,880 (1 in 7) Maine licensed drivers age 16-24 were involved in motor vehicle crashes on Maine roads.

Among these drivers 2,538 were injured, 1,025 transported by EMS, 115 hospitalized, and 49 were hospitalized or died with a head injury.

For young drivers the rate of injury in motor vehicle crashes was more than 3 times the rate for older drivers.

Figure 1. Rates of driver injury in motor vehicle crashes



One in seven Maine drivers age 16-24 was involved in a motor vehicle crash during 1996

Compared to older drivers, young drivers were more likely to be involved in crashes at night, on rural roads, using excessive speed, and driving with a suspended license. Crashes involving vehicles that ran off the road and/or occurred at a curve in the road were more common for younger drivers.

During a crash the likelihood of an injury was increased by 2.8 times if alcohol was involved and 1.6 times if illegal or unsafe speed was involved.

Young drivers involved in crashes had lower rates of belt use than older drivers. Fifty-two percent of young drivers who were hospitalized or died with a head injury were not using a seat belt.

Fifty-two percent of young Maine drivers who were hospitalized or died with a head injury during 1996 were not using a seat belt.

Of the 14,880 young Maine drivers involved in crashes during 1996, 6,208 (42 percent) also had passengers riding with them. Four out of five of their passengers were other teens and young adults who also experienced significant injuries and medical costs.

The impact of passengers on the outcomes of young driver crashes added 50 percent to the number of injuries, EMS transports, and hospitalizations.

Table 1. Outcomes of 1996 crashes involving Maine drivers age 16-24.

Outcome measure	Drivers	Passengers	Total occupants
Persons involved	14,880	9,260	24,140
Injured	2,538	1,362	3,900
Transported by EMS#	1,025	552	1,577
Hospitalized#	115	65	180
Hospital days#	583	341	924
Hospital charges#	$1,713,782	$919,155	$2,632,937
Died	18	17	35
Years of potential life lost	1,027	980	2,007

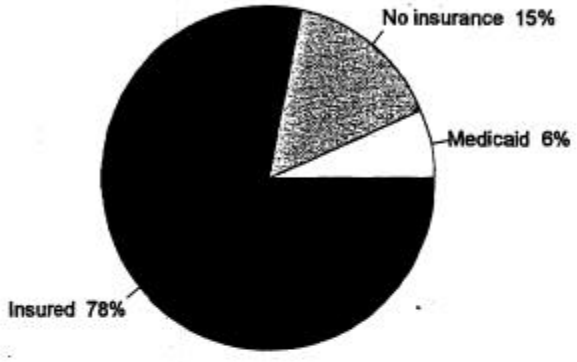
 # Represents linked records only and may underestimate actual counts.

Compared to older drivers, young drivers had higher rates of crash occurrence, hospitalization and cost. If young drivers had the same driving experience as older drivers, the potential reduction in medical cost (based on inpatient charges) would have been $1.8 million, or a 70 percent reduction.

Young drivers accounted for 12 percent of the drivers but 28 percent of the medical cost.

Figure 2. Who paid for inpatient hospital charges?

Maine drivers age 16-24, 1996 CODES data



Young driver crashes represent a significant cost to employers who most often pay for care through insurance

Seventy percent of the inpatient medical cost for young drivers was paid for by commercial insurers and HMOs. This potentially represents a significant cost to Maine employers who cover young drivers either as employees or dependents under their health plans.

The average young driver hospitalized during 1996 spent 5 days in the hospital at an average charge of $14,900. These figures do not include the additional costs of physicians bills and follow-up care.

Passengers occupying vehicles driven by young drivers accounted for 35 percent of the total hospital costs resulting from these crashes.

Males drivers had higher crash rates than female drivers, and young male drivers along with their passengers accounted for 70 percent of the hospital costs for crashes involving drivers age 16-24.

For more information:

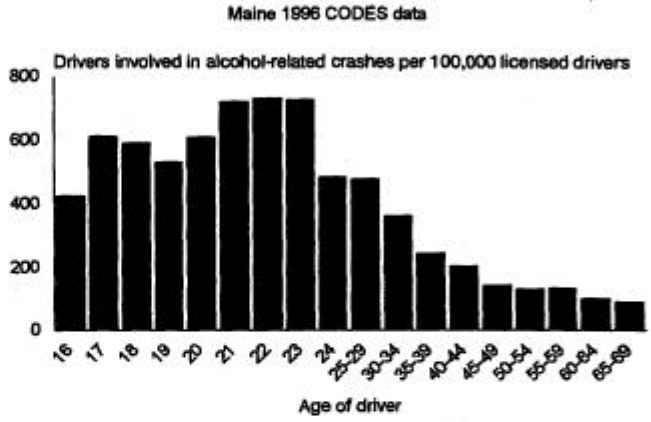
More information on the CODES project and CODES results from other states can be accessed by Internet at http://www.cvic.edu/codes. General information on highway traffic safety, in addition to CODES information, can be accessed at http://www.nhtsa.dot.gov/people/ncsa.

During 1996, 1,132 young drivers were involved in alcohol-related crashes. Their rate of involvement in alcohol-related crashes was more than two and one-half times that of older drivers. While these crashes represented only 5 percent of the persons involved in crashes, they accounted for 33 percent of the hospitalizations and 38 percent of hospital costs.

For young drivers, alcohol was a factor in 1 in every 3 crashes that resulted in a death or hospitalization. Alcohol-related crashes accounted for $1.0 million of the $2.6 million in hospital inpatient charges incurred by young drivers and their passengers.

For young Maine drivers, alcohol was a factor in 1 in every 3 crashes that resulted in death or hospitalization during 1996

Figure 3. Rates of alcohol related motor vehicle crashes



Drivers in alcohol-related crashes were also less likely to have used seat belts.

The Maine CODES Project Advisory Committee.

Maine Health Information Center (report and data preparation)
Office of Data, Research, and Vital Statistics, Bureau of Health, Maine Department of Human Services (project coordinator)
Maine Department of Public Safety, Bureau of Highway Safety
Maine Department of Public Safety, Emergency Medical Services
Maine Department of Secretary of State, Bureau of Motor Vehicles
Maine Department of Transportation
Childhood Injury Prevention and Control, Department of Human Services
Physicians from Maine Medical Center and Eastern Maine Medical Center

Supported by the National Highway Traffic Safety Administration